FILTER ELEMENT WITH PLASTIC FILTER CASING

The invention relates to a filter element comprising a supporting pipe which is surrounded by a mat filter, which in turn is enclosed in a filter casing with openings delimiting a filter chamber and wherein the filter element has two end caps arranged on the frontal surfaces.

Such filter elements (DE 4312705A1) are known in a plurality of embodiments and serve generally to free polluted fluids of pollutants, especially fluids in the form of hydraulic power oil, which are intercepted by the mat filter of the filter element and are retained and held out of the fluid current. When the mat filter is filled completely with pollutants, it is to be exchanged for a new mat filter or the complete filter element is to be replaced by an entirely new filter element. In this device, the polluted fluid passes through at least one of the two end caps through a corresponding inlet opening into the filter element and flows through this element for a purification process occurring from the outside inward, for which purpose the mat filter is arranged between the supporting pipe with openings and the filter casing likewise provided with openings. In order to attain a high pollutant intercepting capacity, the mat filter is pleated with a plurality of pleats, in other words is arranged in folds around the supporting pipe. The other end cap can be provided with a safety or bypass valve and can allow the fluid current to bypass the filter element insofar as the mat filter no longer allows fluid penetration because it is completely clogged with pollutants.

In this known filter element according to DE 4312705 A1, the cylindrical filter casing which surrounds the mat filter is formed of an expanded metal fabric, whereby the two ends of the

casing bent toward one another are bent inward to open in a retaining clip, which forms the foundation for a layer of adhesive, the adhesive in this case being a two-component adhesive. Because of the plurality of manufacturing stages and the accompanying structural components, the known filter element is costly to manufacture. Furthermore, there are maintenance problems with such filter elements when they become unusable, especially in relation to the aforementioned expanded metal casing of metal fabric. Then, final maintenance of the filter element, for example when the filter element is to be processed as an entirety in a suitable shredder unit, is consequently not possible and limits the recycling capacity to individual components of the filter element.

Starting from this state of the art the object of the invention is to disclose a filter element which can be manufactured more economically while also increasing the possibilities for recycling such a filter element as an entirety. Such an object is disclosed by a filter element having the features found in Claim 1.

Owing to the fact that according to the disclosure part of Claim 1 the filter casing consists of a plastic casing which is formed of a flat blank, of which the two ends which are bent toward one another with formation of the filter chamber can be tightly joined together by being sealed with a sealing seam produced by heat-sealing-, heating element- or ultrasonic-welding method, the longitudinal seam clasp for the formation of the sealing seam can be deleted and also the high-cost folding back of the ends of the filter casing need not be executed. Additional must not be expected until the two-component adhesive is hardened in the trough-like receiving channel formed by the longitudinal seam clasp. By using a plastic casing as filter casing, and by suitable selection of the plastic material, without further difficulty this arrangement can be heat-sealed

together or processed by an ultrasonic welding method, whereby high resistance and stability of the transverse sealing seam is also guaranteed during subsequent operation. Since it is still a question of plastic material being used as filter casing, this casing can later be disposed of and recycled with no problem; even if necessary together with the entire filter element by shredding or the like.

With one especially preferred embodiment of the filter element of the invention the mat filter is pleated and comprises plastic materials which, with formation of an additional filter fold and with flush alignment of the mat ends one against the other can allow these ends to be tightly joined together with one another by means of an ultrasonic welding method. Insofar as the ends of the filter casing are also connected with one another by means of an ultrasonic welding method, then a large part of the relevant sealing for the filter element can be manufactured using such a manufacturing method, which saves on manufacturing cost.

It has been shown to be particularly advantageous in the manufacture of the filter element to provide the mat filter in folds around the cylinder, which mat filter can be thrust open on the supporting pipe, provided with a larger exterior diameter than the interior diameter of the filter casing. Preferably then the mat filter is held together at one of its working ends in such a manner that a sort of cone-shape is developed, which simplifies its introduction into the cylindrical filter casing.

According to another especially preferred embodiment all of the structural parts of the filter element are of plastic materials, so that the filter element can be recycled as an entirety in a shredder unit.

Hereinafter the filter element of the invention is to be explained in greater detail relative to the drawing.

In the drawing :

Fig. 1 is a perspective view of the filter element;

Fig. 2 is a perspective representation of one manufacturing step relating to the pleated mat filter;

Figs. 3 and 4 show a segment relating to the sealing seam between the two ends of the filter casing, manufactured by the ultrasonic welding method or the heat-sealing method;

Fig. 5 is a sort of composite structural drawing of the components of the filter element in the form of the filter casing, the mat filter and the supporting pipe.

The filter element of Fig. 1 comprises a fluid-permeable supporting pipe 10 (cf. Fig. 5) which is surrounded by a mat filter 12, which in turn is enclosed by a filter casing 16 with openings 18 delimiting a filter chamber 14, and the filter element has end caps 20,22 (cf. Fig. 1).

Supporting pipe 10 is formed of a cylindrical pipe segment and has circular openings for passage of the fluid. The longitudinal ends of supporting pipe 10 are joined together by means of a welding seam, not shown in greater detail.

Supporting pipe 10 is open at the two frontal ends. Filter casing 16 consists of a plastic casing, especially of a polyamide or polyethylene compound, with good heat-adhesion properties and/or a good capacity for processing by ultrasonic welding. The plastic filter casing is first formed of a

not shown flat blank, and the two ends 24, 26, bent around toward one another, are joined together securely with one another by a sealing seam 28 produced by the aforementioned method, forming a filter chamber 14. Sealing seam 28 produced by the ultrasonic welding method is represented in Fig. 3, whereas the hot melt sealing seam 28 produced according to the heat-sealing method is the object of Fig. 4. According to the representations of both Figs. 3 and 4, an overlapping has been developed in the area of the two ends 24 and 26 of filter casing 16 in both cases. This is particularly important when the adhesive sealing (hot melt) which is produced for the heat-sealing method requires a more extensive contact surface to obtain a secure hold than does the sealing produced according to the ultrasonic welding method.

As is shown especially in Fig. 2, mat filter 12 is pleated, in other words is folded, and displays the traditional plastic materials in a supporting fabric not shown in greater detail, which are suitable for the filtering of a fluid and consequently for the cleaning out of pollutants. To produce a mat filter 12 with cylindrical interior diameter which delimits filter chamber 14, the two open ends 30 engage against one another intermittently, thus forming an additional filter fold 32. Subsequently the ends 30 are tightly joined together with one another by an ultrasonic welding method, whereby the bottom tool 34 is stationary and the top tool 36 undertakes the delivery movement of the device in the direction shown by the arrow. Following conclusion of the welding process the two ends 30 of mat filter 12 are joined together securely with one another with formation of an additional filter fold 32 and the strip-like individual filter folds 32 engaging on one another can be removed from one another and then form the hollow cylindrical filter chamber. In order to attain a construction of the filter element as shown in Fig. 6, first an assembly of the individual component parts according to the representation of Fig. 5 is undertaken. Thus first of all mat filter 12 which is folded on the cylinder and can be pushed open

on supporting pipe 10 can be provided with a larger exterior diameter than the interior diameter of the associated filter casing 16. Mat filter 12, as shown clearly in Fig. 5, is then brought inward at its top frontal end 38 in such a manner that a cone 40 is formed, which facilitates its introduction into cylindrical filter casing 16 and which is canceled out as soon as mat filter 12 is introduced entirely into closed filter casing 16.

In order to guarantee a complete recycle capacity of the filter element, it is provided that mat filter 12 and filter casing 16 are of a recyclable plastic material. Furthermore it can also be provided that the two end caps 20,22 are formed of a recyclable plastic material. Likewise, in expansion of this concept, supporting pipe 10 can also be of a recyclable plastic material. The openings 18 in plastic filter casing 16 are formed by punching out, and are in the shape of a circular cross section. The polluted fluid passes through the filter element from the exterior to the interior in filter chamber 14, whereby a cleaning out is performed with the fluid passage through pleated mat filter 12, which receives and holds the pollutants, whereinafter the cleaned out fluid flows through the outlet opening 42 of top end cap 20 in the direction as shown in Fig. 1. With reference to the bottom end cap 22 shown in Fig. 1 a not shown bypass or safety valve can be mounted facing downward in an offset projection. For the production of sealing seam 28 of filter casing 16 this casing is stretched out on a cylindrical auxiliary tool and then processed from the outside with the ultrasonic welding tool, thus producing sealing seam 28.

Mat filter 12 can be designed for low pressure or high pressure. In either case it can be of polyester or polyamide materials as well as fiberglass paper. Beyond that, mat filters which can be cleared of pollutants are of wire fabric materials. The perforated material for filter casing 16 can have a hole dimension of 1.25 mm with hole spacings in feed direction of 1.9 mm and

middle to middle spacing of 3.25 mm in horizontal alignment. Thus an open surface of 38% is obtained for the fluid flow-through.

Instead of the ultrasonic welding tool indicated with reference 36 in Fig. 2, one heating element can be used which causes welding of the plastic material for mat filter 12 and likewise can be used for the production of sealing seam 28.

The filter element described above can be produced economically because of its composition and is almost entirely recyclable. Of particular interest, insofar as the filter element is completely of plastic, it can be disposed of as an entirety in shredder units or the like.